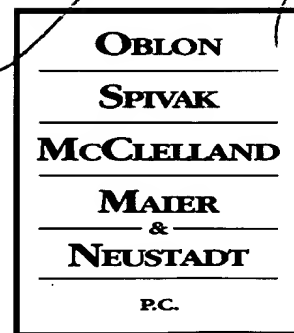




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DEC 09 2003  
TC 1700



ATTORNEYS AT LAW

Docket No.: 192210US0

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

RE: Application Serial No.: 09/577,158  
Applicants: Tsuyoshi KOWAKA, et al.  
Filing Date: May 24, 2000  
For: POLYVINYL ALCOHOL POLYMER PRODUCTION  
METHOD AND POLYVINYL ALCOHOL POLYMER  
Group Art Unit: 1713  
Examiner: Wilson, D.

SIR:

Attached hereto for filing are the following papers:

**Appeal Brief w/Appendix (In Triplicate), Request for Extension of Time (One Month)**

Our credit card payment form in the amount of \$440.00 is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.

  
Norman F. Oblon

Registration No. 24,618

Customer Number

**22850**

(703) 413-3000 (phone)  
(703) 413-2220 (fax)

Harris A. Pitlick  
Registration No. 38,779



DOCKET NO. 09/577,158 US0

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TC 1700

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :  
TSUYOSHI KOWAKA, ET AL. : EXAMINER: WILSON, D.  
SERIAL NO: 09/577,158 :  
FILED: MAY 24, 2000 : GROUP ART UNIT: 1713

DIV. CPA FILED: SEPTEMBER 6, 2002

FOR: POLYVINYL ALCOHOL :  
POLYMER PRODUCTION METHOD  
AND POLYVINYL ALCOHOL POLYMER

APPEAL BRIEF

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal of the Final Rejection dated April 29, 2003, of Claims 55-58 and 60.

A Notice of Appeal was filed on September 29, 2003.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Kuraray Co., Ltd. having an address at

1621, Sakazu, Kurashiki-shi, Okayama-ken, Japan.

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II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignee are aware of no appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

### III. STATUS OF THE CLAIMS

Claims 55-58 and 60, all the claims in the application, stand rejected and are herein appealed.

### IV. STATUS OF THE AMENDMENTS

No amendment under 37 CFR 1.116 has been filed.

### V. SUMMARY OF THE INVENTION

As recited in Claim 55, the invention is a method of producing polyvinyl alcohol polymer comprising:

saponification of a polyvinyl ester in an alcohol-containing organic solvent under the presence of a saponification catalyst, wherein saponification is carried out with a mole ratio of alcohol with respect to polyvinyl alcohol of 1.0 to 3.0, while distilling off the carboxylic ester produced by the saponification reaction, wherein said saponification comprises:

a first stage saponification process, comprised in turn of a primary saponification reaction, in which a saponification reaction is carried out in a kneader mixer by mixing the polyvinyl ester in the alcohol-containing organic solvent under the presence of a saponification catalyst and

a subsequent secondary saponification reaction, in which a saponification reaction is carried out in a tower reactor while distilling off the carboxylic ester that is produced; and

a subsequent second stage saponification process, comprised in turn of a primary saponification reaction, in which a saponification reaction is carried out in a kneader mixer by mixing the polyvinyl ester in the alcohol-containing organic solvent under the presence of a saponification catalyst and

a subsequent secondary saponification reaction, in which a saponification reaction is carried out in a shell and tube evaporator while distilling off the carboxylic ester that is produced,

wherein the degree of saponification attained in said secondary saponification reaction of the second stage is 99.6 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

See the specification at the paragraph bridging pages 10 and 11; page 12, line 17; and the Examples.

## VI. ISSUES

Whether Claims 55-58 and 60 are unpatentable under 35 U.S.C. §103(a) over

(1) JP 03-0430807 (JP '807) in view of *Organic Chemistry*, pages 682-83 (Morrison et al), U.S. 5,352,750 (Yanai et al), and U.S. 4,110,494 (Schindler et al); or

(B) U.S. 3,080,350 (Imai et al) in view of Morrison et al, Yanai et al, and Schindler et al, optionally in view of Examiner's Notice;

and further in view of Admissions by Applicant and Yanai et al, and still further in view of the Kirk-Othmer excerpt on evaporation (Standiford), U.S. 3,684,768 (King et al) or U.S. 5,418,269 (Ishiwa et al)?

## VII. GROUPING OF CLAIMS

Claims 56-58 each stand or fall separately from Claim 55.

## VIII. ARGUMENT

Claims 55-58 and 60 stand rejected under 35 U.S.C. §103(a) over

(1) JP '807 in view of Morrison et al, Yanai et al, and Schindler et al; or

(B) Imai et al in view of Morrison et al, Yanai et al, and Schindler et al, optionally in view of Examiner's Notice;

and further in view of Admissions by Applicant and Yanai et al, and still further in view of Standiford, King et al or Ishiwa et al.

That rejection is untenable and should not be sustained.

The present invention concerns a polyvinyl alcohol polymer (PVA) production method. To be more specific, this invention concerns, along with PVA, a method of producing PVA polymer by saponifying a polyvinyl ester in an alcohol-containing organic solvent under the presence of a saponification catalyst and with which the saponification reaction is carried out while distilling off the carboxylic acid ester that is produced by the saponification reaction.

Claim 55, the now broadest claim, recites:

A method of producing polyvinyl alcohol polymer comprising:

saponification of a polyvinyl ester in an alcohol-containing organic solvent under the presence of a saponification catalyst, wherein saponification is carried out with a mole ratio of alcohol with respect to polyvinyl alcohol of 1.0 to 3.0, while distilling off the carboxylic ester produced by the saponification reaction, wherein said saponification comprises:

a first stage saponification process, comprised in turn of a primary saponification reaction, in which a saponification reaction is carried out in a **kneader mixer** by mixing the polyvinyl ester in the alcohol-containing organic solvent under the presence of a saponification catalyst and

a subsequent secondary saponification reaction, in which a saponification reaction is carried out in a **tower reactor** while distilling off the carboxylic ester that is produced; and

a subsequent second stage saponification process, comprised in turn of a primary saponification reaction, in which a saponification reaction is carried out in a **kneader mixer** by mixing the polyvinyl ester in the alcohol-containing organic solvent under the presence of a saponification catalyst and

a subsequent secondary saponification reaction, in which a saponification reaction is carried out in a **shell and tube evaporator** while distilling off the carboxylic ester that is produced,

wherein the degree of saponification attained in said secondary saponification reaction of the second stage is 99.6 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

(Emphasis added.)

As described in the specification under "Description of the Prior Art," beginning at page 1, second paragraph, it is generally believed that in order to raise the degree of saponification of PVA in cases where alcohol is used to saponify a corresponding polyvinyl ester, the mole ratio of methanol with respect to PVA must be made high. However, too high a mole ratio causes other problems, such as PVA gelling, which then requires a large amount of organic solvents, such as dimethyl sulfoxide (DMSO) to prevent gelling, resulting in a concentration of PVA obtained of only a few percent at maximum. Thus, one of the objects of the present invention is a method of producing PVA polymer having a generally higher degree of saponification than that of the prior art, that is obtained at a relatively low mole ratio of alcohol.

For attaining the above object, as described at page 9, lines 3-21 of the specification, it is preferable to carry out the saponification reaction continuously comprised of a primary reaction, in which a polyvinyl ester is mixed in an alcohol-containing organic solvent under the presence of a saponification catalyst to carry out the saponification reaction, and a

secondary reaction, in which the saponification reaction is carried out while distilling off the carboxylic acid ester that is produced.

As described beginning in the paragraph bridging pages 10 and 11 of the specification, and as recited in the present claims, it is further preferable to carry out the above in two stages.

The degree of saponification of PVA can then be increased and the reaction can be controlled by adjusting the mole ratio of alcohol with respect to PVA and the degree of saponification in the secondary saponification can be controlled by adjusting the rate at which the alcohol and carboxylic acid ester are distilled off.

None of the applied prior art addresses the above-discussed problem of the prior art degree of obtaining a relatively high degree of saponification of PVA by using a relatively low mole ratio of alcohol with respect to PVA and a concomitant relatively high (10% or more) PVA concentration in the saponification reaction solution.

Indeed, such a low mole ratio of alcohol could not possibly be arrived without first coming up with the saponification comprised of the primary and secondary saponification reactions.

As described in the specification beginning in the paragraph bridging pages 12 and 13, in the first stage and second stage saponification processes, it is important for the saponification reactor in which the primary saponification reaction is carried out to reliably mix the saponification reaction stock solution (paste), comprised of polyvinyl carboxylate, alcohol, and organic solvent, and the saponification catalyst, in a short time. From this standpoint, a reactor that is substantially of the complete mixing type is preferably used. Examples of reactors that are close to being such a complete mixing type reactor include line mixers and various other mixers of high mixing efficiency and mixers equipped with various types of stirring blades. Among such mixers, the use of a kneader type mixer is preferable,

for example the mixer made under the trade name of S1 Mixer(Type SMJ40) by Sakura Plant Co., Ltd.

As described in the specification beginning in the paragraph bridging pages 14 and 15, if the two-stage saponification, each comprised of first stage, and a second stage saponification processes, is to be employed, a wetted wall tower or tray tower is preferably used for the secondary saponification reaction of the first stage, and a shell and tube evaporator or plate fin type evaporator or an equivalent is preferably used in the secondary saponification reaction of the second stage so as to keep uniform the flow conditions of the PVA polymer solution obtained by the primary saponification reaction. Further, the heat transfer efficiency will be excellent, and methyl acetate can be distilled off readily. Especially in the case where an organic solvent of high boiling point is to be used, the saponification process of the second stage is preferably carried out under highly depressurized conditions, and in order to avoid temperature drops due to sudden flashing, it is preferable to use a shell and tube evaporator, with which the reaction solution obtained by the primary saponification reaction is supplied in an up-flowing manner.

Methyl acetate should be distilled off as much as possible in the first stage in order to achieve a high degree of saponification. Methyl acetate should be 1 wt% or less in the first stage in order to achieve a high final degree of saponification of 99.6 mole % or more. From this point of view, a tower reactor is more advantageous in removing methyl acetate by distillation compared to an evaporator.

In consideration of the above, the best combination of apparatuses is one which can achieve a high degree of saponification of 99.6 mole % or more and a high concentration of the PVA in the saponification reaction solution of 10 wt% or more. The present combination of apparatuses is composed of a kneader mixer as the primary saponification reactor in the first stage, a tower reactor as the secondary saponification reactor in the first stage, a kneader



mixer as the primary saponification reactor in the second stage, and a shell and tube evaporator as the secondary saponification reactor in the second stage, as recited in above-discussed Claim 55.

If, on the other hand, a tower reactor were employed as the secondary saponification reactor in the second stage, a complicated reboiler such as a compulsory circulation type reboiler would be necessary because of the high viscous reaction solution of the secondary saponification reaction of the second stage, which is disadvantageous in equipment cost and operation cost compared to the ordinary thermosiphon type reboiler.

Also, on the other hand, if a shell and tube evaporator were employed as the secondary saponification reactor in the first stage, such a high final degree of saponification as 99.6 mole% or more could not be attained compared to employing a tower reactor, because an evaporator is disadvantageous in distilling off of methyl acetate compared to a tower reactor. A shell and tube evaporator is excellent as a reactor in the secondary saponification reaction in the second stage in order to avoid temperature drops due to sudden flashing by depressurization.

The applied prior art neither discloses nor suggests such a combination of apparatuses in order to achieve a high degree of saponification of 99.6 mole % or more and the concentration of the PVA in the saponification reaction solution of 10 wt% or more with a relatively low mole ratio of alcohol with respect to polyvinyl alcohol.

The Declaration under 37 CFR 1.132 of named coinventor Kazunori Watanabe (Watanabe Declaration) of record demonstrates the superiority of the presently-recited “kneader mixer-tower reactor-kneader mixer-shell and tube evaporator” combination of the present claims, with regard to achieving a final degree of saponification. In the Watanabe Declaration, Experiment 1 is according to the present invention. Experiments 2-4 are not. Experiment 2 uses a tower reactor for the second saponification reaction of both the first and

second stages; Experiment 3 uses a shell and tube evaporator for the second saponification reaction of the first stage, and a tower reactor for the second saponification reaction of the second stage; and Experiment 4 uses a shell and tube evaporator for the second saponification reaction of both the first and second stages. A summary of the results is also of record. None of the applied prior art could have predicted these results.

The Final Rejection, in paragraph 6, relies on the “previous Office Action” (dated October 3, 2002). The following paragraph number references apply to this previous Office Action.

The Examiner at paragraph 13 concedes that JP ‘807 “doesn’t appear to teach reactions wherein the concentration of the polyvinyl alcohol polymer is 10 wt% or more in a methanol/diethyl sulfoxide solvent mixture, some degree of latitude in what has been exemplified.” Such “degree of latitude” does not take the place of prior art. Imai et al is even less pertinent than JP ‘807 as the Examiner at paragraph 10 concedes that Imai et al “uses a large excess of solvent” and at paragraph 11, is “also deficient in regard to the mol ratio of alcohol solvent to polyvinyl alcohol.”

The remaining prior art has clearly been applied with the present disclosure as a guide, yet the combined prior art does not teach one skilled in the art how to obtain PVA polymer with a relatively low mole ratio of alcohol with respect to polyvinyl alcohol, a relatively high degree of saponification, and a relatively high PVA polymer concentration in the saponification reaction solution, all as required by Claim 55.

The Examiner at paragraph 15 concedes that none of the applied prior art that is specifically drawn to PVA technology teaches the above-discussed “kneader mixer-tower reactor-kneader mixture-shell and tube evaporator” combination of the present claims.

For purposes of the use of kneader mixers in the primary saponification reaction in both the first and second stage saponification processes, the Examiner at paragraph 15 simply

relies on Appellants' admission that "kneader mixers are well known in the art of polymer technology [for thoroughly mixing reactants.]" However, this admission adds nothing, because none of the applied prior art discloses or suggests the advantages obtained from the use of kneader mixers in this way, combined with a tower reactor and a shell and evaporator, as required by the claims.

Regarding Yanai et al's disclosure of distilling off the ester, e.g., methyl acetate, at column 10, lines 11-32 and column 14, lines 45-52 which includes a disclosure of distillation in a column system, the Examiner at paragraph 16 finds that this would be a tower reactor as defined by Appellants. However, the Examiner does not explain why one skilled in the art would use such a tower reactor in only the secondary saponification reaction of a first stage saponification process of an over-all two-stage saponification process, let alone as part of the above-discussed "kneader mixer/tower reactor/kneader mixer/shell and tube evaporator" combination.

Regarding the use of a shell and tube evaporator, the Examiner at paragraph 17 finds that they are the most widely used type of film evaporator used, among which one version is the falling film type, and in the field of polymer technology it is well known to employ film type evaporators. The Examiner holds that it would have been obvious to use such an apparatus "for the removal of volatile methyl acetate in either stage" of the two-stage saponification process which the Examiner finds is suggested by the prior art.

In reply, it has been not known to use such a shell and tube evaporator in a saponification reaction, much less to reduce the amount of alcohol required to achieve high degrees of saponification. But even if a shell and tube type evaporator were suggested generally, the Examiner still does not explain why it would have been obvious to one skilled in the art to use it as part of the above-discussed "kneader mixer/tower reactor/kneader mixer/shell and tube evaporator" combination.

In the Final Office Action, the Examiner suggests that the motivation to carry out the presently-claimed method need not be identical to that of Appellants in order to establish obviousness. In reply, while this may be true, the Examiner has not provided this alternative motivation. While the Examiner quotes from various passages in Yanai et al and Standiford, these isolated teachings do not provide the requisite motivation.

Nor has the Examiner directly addressed the above-discussed results in the Watanabe Declaration.

In sum, while the goals achieved by the presently-claimed method were desired by the prior art, the prior art did not know how to achieve them prior to said method.

Claim 56 is separately patentable, because the applied combination of prior art neither discloses nor suggests the method of Claim 55, wherein the degree of saponification attained in said primary saponification reaction of the first stage is 70 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

Claim 57 is separately patentable, because the applied combination of prior art neither discloses nor suggests the method of Claim 55, wherein the degree of saponification attained in said secondary saponification reaction of the first stage is 85 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

Claim 58 is separately patentable, because the applied combination of prior art neither discloses nor suggests the method of Claim 55, wherein the degree of saponification attained in said primary saponification reaction of the second stage is 93 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

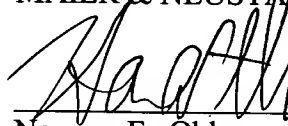
For all the above reasons, it is respectfully requested that all the above rejections be REVERSED.

IX. CONCLUSION

For the above reasons, it is respectfully requested that all the rejections still pending in the Final Office Action be REVERSED.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



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Norman F. Oblon  
Attorney of Record  
Registration No. 24,618

Customer Number  
**22850**

Tel: (703) 413-3000  
Fax: (703) 413 -2220  
(OSMMN 08/03)  
NFO/HAP/cja

Harris A. Pitlick  
Registration No. 38,779

## APPENDIX

### CLAIMS ON APPEAL

55. A method of producing polyvinyl alcohol polymer comprising:

saponification of a polyvinyl ester in an alcohol-containing organic solvent under the presence of a saponification catalyst, wherein saponification is carried out with a mole ratio of alcohol with respect to polyvinyl alcohol of 1.0 to 3.0, while distilling off the carboxylic ester produced by the saponification reaction, wherein said saponification comprises:

a first stage saponification process, comprised in turn of a primary saponification reaction, in which a saponification reaction is carried out in a kneader mixer by mixing the polyvinyl ester in the alcohol-containing organic solvent under the presence of a saponification catalyst and

a subsequent secondary saponification reaction, in which a saponification reaction is carried out in a tower reactor while distilling off the carboxylic ester that is produced; and

a subsequent second stage saponification process, comprised in turn of a primary saponification reaction, in which a saponification reaction is carried out in a kneader mixer by mixing the polyvinyl ester in the alcohol-containing organic solvent under the presence of a saponification catalyst and

a subsequent secondary saponification reaction, in which a saponification reaction is carried out in a shell and tube evaporator while distilling off the carboxylic ester that is produced,

wherein the degree of saponification attained in said secondary saponification reaction of the second stage is 99.6 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

56. The method of Claim 55, wherein the degree of saponification attained in said primary saponification reaction of the first stage is 70 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

57. The method of Claim 55, wherein the degree of saponification attained in said secondary saponification reaction of the first stage is 85 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

58. The method of Claim 55, wherein the degree of saponification attained in said primary saponification reaction of the second stage is 93 mole% or more and the concentration of the polyvinyl alcohol polymer in the saponification reaction solution is 10 wt% or more.

60. The method of Claim 55, wherein said alcohol-containing organic solvent comprises at least one solvent selected from the group consisting of dimethyl sulfoxide, dimethylformamide, dimethylacetamide, N-methylpyrrolidone, ethylenediamine, and diethylenetriamine.